Natural Chinook salmon fry response to pesticide input into the Sacramento River: Two year biomarker survey in the lower river.

John Scott Foott

Public Comments

No public comments were received for this proposal.

Technical Synthesis Panel Review

Proposal Title

#0103: Natural Chinook salmon fry response to pesticide input into the Sacramento River: Two year biomarker survey in the lower river.

Final Panel Rating
inadequate

Technical Synthesis Panel (Primary) Review

TSP Primary Reviewer's Evaluation Summary And Rating:

The overall goal of this study was to assay fry for signs of contaminants in the Sacramento river. The author provided good justification, citing the incidence of rice persticides in the river. Fry will be surveyed in 2 sections (upper and lower) of the River, and pathology determined. The null hypothesis is that there is no difference in pathology of fry between areas. The authors propose to collect 20 chinook salmon fry/week at 2 sites = 560 fish. They will assay the fish for various measures of histopathology (acetylcholinesterase activity, CY1A (Cytochrome P450), metallothioneins, apoptasis, lipofuscein, and myxosporidians.

Additional Comments:

Several problems were found with the proposal. There was no justification of why specific markers were chosen. One reviewer mentioned that rice pesticides are no longer a problem (either gone or much reduced) from 1980s, but apparently apple orchard contaminants are more serious now. Also, time proposed for sample collection (Jan–Apr) is before the pesticide actually runs into the river in May–June. No monitoring was proposed for contaminants in sediments or water in these two areas. Therefore, it is difficult to imagine how

the pathology in fish will be related to anything in environments. There was no plan on what to do with the research results once they were obtained.

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Technical Synthesis Panel (Discussion) Review

TSP Observations, Findings And Recommendations:

Natural Chinook salmon fry response to pesticide input into the Sacramento River: two year biomarker survey in the lower River

Primary Reviewer Ranking: Inadequate

Secondary Reviewer Comments: No statistics proposed. No justification of biomarkers. References used were old. Design poor. No monitoring of sediments for contaminants. Cannot relate pathology scores to what is in environment. Toxicology experience needed. Secondary Reviewer Ranking: Inadequate

Panel Discussion: No real demonstration biomarkers are responsive to pesticides. Very short; only 2 page proposal.

Final Ranking: Inadequate

Technical Review #1

proposal title: Natural Chinook salmon fry response to pesticide input into the Sacramento River: Two year biomarker survey in the lower river.

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**No, the goal to monitor the occurrence and magnitude of contaminant biomarkers are not internally consistent with the document. The sub−lethal effects of contamination exposure could indeed be one factor in the declining returns of natural fall−run Chinook salmon but there as the proposal stands there is no direct linkage between environmental contamination at the sample sites, during the time samples are taken and the histological and physiological parameters measured in the fish. Some direct measurement of residues in tissue, water and / or sediment i.e. (Presence of dormant sprays, pesticide residues and / or heavy metals) needs to be a part of this data set. Without this data it would be difficult to link results from this study to previous studies. To what degree these stressors among others may or may not play in early life stage salmon survival is not directly addressed in this proposal.**
Rating	**poor**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The author states that "despite marked improvements in upper Sacramento River Habitat… natural production of Fall−run Chinook… has declined." In a study of the impact of rice pesticides on the aquatic ecosystems of the Sacramento River and Delta (California), published in Rev Environ Contam Toxicol. 1999; 159:95−110. J. L. Byard stated that since the early 1980s, when molinate was demonstrated to have killed carp in agricultural drains, an intensive research effort has been undertaken to assess the impact of rice pesticides on aquatic ecosystems in the Sacramento River and Delta.** **The abstract states; No impact has been found that can be clearly attributed to rice pesticides. However, the rice insecticides methyl parathion and carbofuran, and probably also bufencarb, reached levels in the River and Delta that based on laboratory bioassays, would have been toxic to aquatic micro invertebrates and, in the case of bufencarb, to early life stages of striped bass. Reductions in micro invertebrate populations could have impacted higher organisms in the aquatic food chain such as striped bass and Chinook salmon. Bufencarb was not used after 1981. Since then, changes in the management of the remaining rice pesticides have resulted in dramatic decreases in the levels of these chemicals in the River and Delta. Levels achieved today (1998) have no known toxicity to aquatic organisms. As releases of rice pesticides were reduced to achieve nontoxic levels in the River and Delta, however, commensurate recoveries of striped bass and Chinook salmon did not occur, suggesting that rice pesticides may have had little or no role in the decline of these species.**
Rating	**poor**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be

useful to decision makers?

Comments	**No, a histological approach alone does not allow interpretation of changes in biomarkers to be correlated to the status or bioavailability of environmental contaminants. The presence and extent of metallothionein, CY1A, as well as the presence of internal parasites can indeed be fine indicators of fish health at two sites along the Sacramento River. As the proposal is written these differences, if any are detected in fish between the two sample sites, these data can't be tied to environmental residues or heavy metals.** **Sample technique described measuring the fish, the separating the head from the carcass, fixing the carcass then freezing. This approach may increase the base line of both upstream and down stream fish, proving the null hypothesis that there is no difference between fish at either sample site.** **The sample period from January through April in each of two successive years, seems to be inappropriate. As described by Bennett, et al. 2001, in the phenology of pesticide use and activities of federally listed, candidate and declining fishes, including Chinook salmon, in the Sacramento–San Joaquin delta, this proposed sample period coincides to pesticides used in dormant orchard and alfalfa crops, not pesticides such as molinate and thiobencarb used in rice production. Furthermore, Finlayson and Faggella in a "Comparison of laboratory observations of fish exposed to herbicides molinate and thiobencarb", published in Trans. of Amer. Fish. Soc., Vol. 115, No. 6, pp: 882–890, state that both pesticides are toxic to salmon and that there effects were additive. However, these herbicides treated waters are retained for 28 days post application, and that these herbicides are discharged into agricultural drains subsequently reaching the Sacramento River in May through June each year.**

Rating	**poor**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**Bernet et al. 1999 states in "Histopathology in fish: proposal for a protocol to assess aquatic pollution" that: Water pollution induces pathological changes in fish. As an indicator of exposure to contaminants, histology represents a useful tool to assess the degree of pollution, particularly for sub−lethal and chronic effects. However, a standardized method for the description and assessment of histological changes, mainly for use in freshwater fish, is still lacking. In this paper, the Bernet et al. propose a standardized tool for the assessment of histological findings which can be applied to different organs. The methodology is based on two factors: (1) the extension of a pathological change is rated with a 'score value'; and (2) the pathological importance of this alteration is defined as an 'importance factor'. The sum of the multiplied score values and importance factors of all diagnosed changes results in different indices. With these indices, statistical analysis can be carried out. Assessment methods for the gills, liver, kidney and skin are described.** **The author of the present proposal does not indicate that environmental parameters of any kind will be taken at the time the fish samples are taken. The histological data from the native fish may be compared to hatchery reared fish but there are many differences between these two populations that could interfere with clear interpretation of results.**
Rating	**poor**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**No. There is no pre−project AChE assay on juvenile salmon. The reference given for the AChE assay Ellman et al. (1961) is 44 years old! There are numerous improvements and modification to this assay over the last 44 years. The fact that there is no pre−project plan to define and refine an AChE assay is of concern. It would be helpful to know that there is already a quantified assay in place in this laboratory.** **The most worrisome gap in this proposal is that while several pesticides are mentioned as potential causative agents none are monitored by the researchers or affiliates at the sample sited during the sample periods. There can be no direct correlation between histology changes and environmental pesticides levels.**
Rating	**poor**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**With no clear cause and effect, resulting data could be skewed to support multiple interpretations. Correlating these data to previous work in this area would be difficult at best.**
Rating	**poor**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**This proposal would result in more balanced results with a biochemical / analytical or environmental chemistry component. It would be preferred to tie the histological findings proposed in this study to tissue residues of water borne pesticides and / or levels of residues or heavy metals in the sediment–water interface.**
Rating	**poor**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**The budget contains FWS O/H of 25.5% and 30.2% benefits. Is it appropriate to pay salaries, benefits and overhead for personnel already supported by USFWS?**
Rating	**fair**

Overall

Provide a brief explanation of your summary rating.

Comments	**I suggest funding of this proposal be denyed. The authors need to incorporate additional data that would help clarify cause and effect as well as correlation to previous studies.**

Technical Review #1

Rating	**poor**

Technical Review #2

proposal title: Natural Chinook salmon fry response to pesticide input into the Sacramento River: Two year biomarker survey in the lower river.

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals for this project, and the hypothesis are clearly stated. The goal of understanding the occurence and magnitude of sub−lethal responses to contaminants in Chinook salmon fry is extremely important and has broad implications for improving salmon restoration projects. Thus, the motivation behind this proposal is sound and timely.**
Rating	**very good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The authors indicate that there are ongoing declines in natural Chinook salmon populations in the Sacramento river, thus the proposed research has important implications for effective management of the river. Given the relative lack of knowledge about the causes of the fishery decline the author's proposed small−scale histological study is certainly appropriate as a starting point.** **The conceptual approach of this proposal, while simple**

	in design, is not clear. The authors do not provide reasons for why the specific biomarkers were chosen nor do they provide information about whether these biomarkers will be appropriate sentinels of poor water quality in the Sacramento river watershed. In addition, the use of the upper and lower regions of the Sacramento river as collection sites and as comparison sites was not justified. The authors do not provide reasons for utilizing these two sites nor do they justify their null hypothesis that there is no difference between the two regions. In addition to this ommission providing confusion, it leads to issues with how the data will be interpreted.
Rating	**fair**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**Given that this proposed project is a pilot study it is reasonable for the authors to propose a broad approach to the use of biomarkers. However, the authors need to explicitly state their hypotheses for each of the biomarkers and most important what the implications are if or when these biomarkers are found. Without these a prior hypotheses it is difficult to understand how these data are going to help build a dataset and how they are going to lead to future studies. Along these same lines of thinking, the proposal lacks any statement of how these data are going to be analyzed and interpreted once they are collected. Once again, these ommissions limit the usefulness of this research in guiding future more in depth studies.**
Rating	**fair**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The strong suit for this proposal is its feasibility. It is designed to be a first step in understanding sub−lethal effects of contaminants using standard histological and biochemical methods. There is every indication that the authors will be successful in gathering the data that is proposed. The only questions are what information the data will provide and how it will be interpreted.**
Rating	**very good**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**The plans for interpreting the data and establishing the link between the various biomarkers and water quality is not made clear. The authors do not describe how the data set would be handled once it is collected. There is also no explicit treatment/ control sites (presumably the upper and lower riversheds provide this control).**
Rating	**fair**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	

	Since this is a pilot study, the contributions to products and larger data systems is not relevant.
Rating	not applicable

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	This project team is well suited to accomplish the tasks that are described in the proposal.
Rating	excellent

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	The budget is appropriate for this study.
Rating	excellent

Overall

Provide a brief explanation of your summary rating.

Comments	This proposal has a number of stong points. The basic question is important and timely and the initial approach seems valid. In addition, the team assembled to collect the data are well-qualified. The simplicity of the approach for this project makes it highly likely to be successful. However, I think that this proposal has serious faults

	in the broader conceptual design of the study. There is little justification of the various biomarkers with respect to why they were chosen in relation to the Sacramento river watershed. Furthermore, the proposal does not present any information concerning how the data will be analyzed and interpreted. These ommissions are critical and raise questions about how useful the data will be once they are collected.
Rating	**fair**

Technical Review #3

proposal title: Natural Chinook salmon fry response to pesticide input into the Sacramento River: Two year biomarker survey in the lower river.

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The major purpose of this grant proposal is to survey nautral Fall−run Chinook salmon fry in two sections (upper and lower) of the Sacromento River. The stated hypothesis is that there is no difference between the two sections of the river.** **The hypothesis is clearly stated; however, if the authors expect no difference than why perform the study? I would suspect that the lower reaches of the Sacramento River with its agricultural run−off may have salmon with elevated levels of CYP1A and metallothionein.** **The goals of the study are to compare the two regions and that is clearly stated. The overall objectives and how this data is to be used needs work.**
Rating	**good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**This is a pilot project and as such is an initial step. However, it is not clear as to how this**

	data will be used in the future and how they will build on their initial findings.
Rating	**poor**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The approach appears to be well designed and Dr. Foott has expertise in monitoring Chinook Salmon. They are appropriate and feasible for meeting the objectives of the project, but lack detail. There is no approach for how this will add knowledge to our current "base of knowledge" except for basic monitoring. Furthermore, the project is unlikely to generate novel information, methodology or approaches. However, the reviewer believes that the authors histological approach is a good route considering the small size of the fry.**
Rating	**fair**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The approach is not fully documented, completely lacks a technical methodological approach and therefore the likelihood of success appears to be poor. It is difficult for the reviewer to determine whether the authors have technical expertise or the ability to perform this work without any significant documentation of methods.**
Rating	

	poor

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**Monitoring of the two sites appears to be appropriately designed; however the authors do not explain how they might deal with changes induced by weather, seasons, etc.**
Rating	**good**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**Larger contributions to larger data management systems are not considered and products of value are not likely to come from this project. It is difficult to determine if interpretable outcomes are likely to come from this project because the cleanliness and applicability of the upper Sacramento as a reference site is not addressed. In fact, it is mentioned in the Project Justification that "despite marked improvements in upper Sacramento River habitat components and large hatcher returns, natural production of Fall−run Chinnok in the Sacramento system has declined over the last decade".**
Rating	**poor**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**Ronald Stone and Kenneth John Nichols have not expressed any track record or expertise in this area. John Scott Foott has significant expertise working with fish, aquaculture, immunology and certainly chinook salmon. However, he has no expressed track record in toxicology.** **The available infrastructure is not described in detail.**
Rating	**poor**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**For the relatively little work proposed the budget seems a little high. However, due to the lack of description of the work plan and methods, it is difficult to discern. Overall, I would judge the budget as slightly high to OK.**
Rating	**fair**

Overall

Provide a brief explanation of your summary rating.

Comments	**The project proposal lacks a defined hypothesis and appears to just monitor a river over a 20-month period of time. The potential outcome of this monitoring is not expressed. While the authors indicate that this is an initial step to discern biomarker responses in the**

	fry, how this information is to be used is not provided. **Furthermore, the authors provide a basic workplan and project description, but it completely lacks an informative and detailed section on methods. Because of this it is difficult to discern whether the authors have the expertise to perform the project.** **Overall, the project description lacks a good hypothesis, is short and non-descriptive, lacks methodology, does not define or investigate a mechanism, and does not fully describe how this information will be used.**
Rating	**poor**